# A Preliminary Single-case Study of Aphantasia in Japan

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# A Preliminary Single-case Study of Aphantasia in Japan*

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Aphantasia is a condition firstly proposed by Zeman in which people show blind imagination despite no assumption of clinical factors. However, in Japan, there have been almost no reports of aphantasia. The present study reports a Japanese single-case of aphantasia, focusing on behavioral imagery abilities. Our case (KI), who realized his blind imagination in his twenties. He had no difficulties in perceiving/discriminating objects and faces and could read and write, although he could not create images. We assessed his imagery abilities, such as vividness, controllability, and cognitive style. We found that he had a complete deficit of visual, tactile, pain, gustatory, olfactory, and somatic images in vividness, while auditory images might have substantial deficit. He could not judge controllability because of his blind imagination. His cognitive style might mainly involve verbal strategies. Our case may be the first report of aphantasia in Japan.

**Key words:** Aphantasia, Imagery ability, Vividness, Controllability, Cognitive style

## Introduction

Mental imagery is a set of representations that gives rise to the experience of viewing a stimulus in the absence of appropriate sensory input: information in memory underlies the internal events that produce the experience (Kosslyn, 2005). It is generally understood that individuals show marked differences in mental imagery. Some distinct imagery abilities, such as vividness (how vividly individuals create images), controllability (the ability to form and modify visual images), and cognitive style (whether individuals adopt visual [visualizer] or verbal [verbalizer] strategies in cognitive processing, such as when the participants were presented learning materials [pictures and texts, which were self-contained], visualizer and verbalizer mainly focused on picture and text information, respectively, which were shown by an eye-tracking study: Koć-Januchta, Höffler, Thoma, Prechtl, & Leutner, 2017) have been reported. In order to measure these imagery abilities, some questionnaires have been used, such as the Questionnaire upon Mental Imagery (QMI: Betts, 1909), the Test of Visual Imagery Control (TVIC: Gordon, 1949; Richardson, 1969), the Vividness of Visual Imagery Questionnaire (Marks, 1973), the Auditory Imagery Questionnaire (AIQ: Hishitani, 2009), and the Verbalizer-Visualizer Questionnaire (VVQ: Richardson, 1977).

Although it is commonly understood that individual differences in imagery abilities are large, some previous studies have reported "blind imagination" (Zeman, Dewar, & Della Sala, 2015, 2016; Zeman et al., 2020). From a clinical point of view, these cases of blind imagination

* We report the present case study with the permission of the participant.

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have already been discussed in previous studies (e.g., Farah, Levine, & Calvanio, 1988; Grüter, Grüter, Bell, & Carbon, 2009; Ji, Kavanagh, Holmes, MacLeod, & Di Simplicio, 2019). For example, individuals with prosopagnosia show difficulties in creating imagery, and this condition is supported by clinical factors. However, the case of blind imagination (with normal vision) was proposed by Zeman et al. (2015, 2016, 2020) despite no assumption of clinical factors. This condition is defined as "aphantasia," or the lack of a "mind's eye" (Zeman et al., 2015).

Psychological findings on aphantasia have begun to be collected in recent studies (Jacobs, Schwarzkopf, & Silvanto, 2018; Keogh & Pearson, 2018; Zeman et al., 2015). Zeman et al. (2015) reported visual imagery ability using the VVIQ (Marks, 1973) in individuals with aphantasia who showed a substantial or complete deficit in voluntary visual imagery. Moreover, individuals with aphantasia showed no or weak visual imagery using the binocular rivalry (Keogh & Pearson, 2018), visual short-term memory (Jacobs et al., 2018), drawings of real-world scenes (Bainbridge, Pounder, Eardley, & Baker, 2021), and measuring the skin conductance level for emotional stimuli (Wicken, Keogh, & Pearson, 2019). For binocular rivalry, Keogh and Pearson (2018) used green-vertical or red-horizontal Gabor patches as experimental stimuli. In the sequence, the participants were first asked to imagine one of two Gabor patches. Thereafter, they were shown binocular rivalry by presenting the two Gabor patches with each left or right eye. Following this, they were asked to respond which image they saw most (green-vertical, perfectly mixed, and red horizontal). If the participants could create a vividly imagery of the Gabor patch in advance, they tend to respond to the same Gabor patch with imagery because it acts as the priming stimuli in the binocular rivalry. People with aphantasia showed a lower priming effect compared with general (non-aphantasic) people. This study showed objective evidence of imagery deficits in people with aphantasia. Moreover, in the visual short-term memory task (Jacobs et al., 2018), there were visual working memory and imagery versions. In the working memory version, the name of one of three geometric shapes ("diamond", "parallelogram", and "triangle") were first presented on a screen. After this, the corresponding shape was presented visually on the screen, within four placeholders (with four corners). After a mask and blank screens, the participants were required to judge whether the target stimulus appeared within the boundaries of the geometric shape. In the imagery version, the task was identical to the working memory version, apart from the stimulus presentation stage. The corresponding shape was not visually presented on screen (only four placeholders with four corners were presented, which marked the visual area where the geometric shape had to be imagined). After the mask and blank screens were presented, the participants were required to judge whether the target stimulus appeared within the boundaries of the imagined geometric shape, exactly like in the working memory version. If the participants created vividness imagery of the geometric shape, they could complete the task. The person with aphantasia showed lower performance compared with the control group, indicating that the person with aphantasia could not create sufficient imagery of geometric shape. According to these previous studies, psychological findings have begun to be examined. However, it is necessary to collect

physiological evidence since there are almost no findings (Dijkstra, Bosch, & van Gerven, 2019).

In daily life, people with aphantasia tend to experience some difficulties (Kendle, 2017). Kendle (2017) collected and compiled many episodes from people with aphantasia. Many people generally claimed that they are more likely to experience that they have no sense of direction (e.g., they cannot see the map as visual imagery), that they cannot share an important life events such as weddings (e.g., they cannot see their wife who wore wedding dress in their memory), and that they cannot feel their emotions from memory (e.g., they cannot feel happiness or sadness from memory because of their imagery deficit).

It is important to understand aphantasia to reduce their difficulties in daily life. However, to the best of our knowledge, there have been almost no studies in Japan examining individuals with aphantasia. A few years ago, we met a person who claimed to have no visual imagery. Based on recent findings (Zeman et al., 2015, 2016, 2020) and the psychological characteristics of the same person, we suspected that he might be a singular case of aphantasia in Japan. By reporting his case as a preliminary study in Japan, we expect to promote the development of aphantasia studies and a better understanding of aphantasia in Japanese society.

## Case report

### *Methods*

### *Participants*

KI (not his actual initials) was a right-handed male living in Japan and 49 years of age at the time we interviewed him for this study. KI was engaged in a service trade, and his work performance was good. He realized his blind imagination in his twenties when he talked to his friends; KI wondered why his friend talked about his car having a scratch even though the car was not present. His friend talked about the image of his car, but KI could not understand that situation because of his blind imagination. Moreover, he felt stressed at work when customers asked him where an item was displayed. KI spent about ten years without a problem at that time; although he had submitted a report about his blind imagination to the personnel department of the company, the personnel director did not address this report. When KI was in his thirties, his department was changed to a busy post that induced a diagnosis of depression. His department was later re-changed to another post in which he could work using only verbal processing, and he spent about ten years without a problem and with good work performance. When KI was in his forties, his post was again changed to a busy post. Since his boss could not understand his blind imagination, KI had to work using a design (using visual images). Based on this trouble, KI had great stress and asked his supervisor and the personnel director to change his post. KI has continued working while appealing for accommodation for his blind imagination.

KI had no difficulty watching animation contents or a flip book, and his memory and reading/writing were intact. KI could differentiate between faces (his wife and sons), but he

had difficulties in imagining these faces from memory. Moreover, although KI remembered the contents of TV programs that he had watched the evening before, he could not recollect scenes from them as visual images. He sufficiently expressed their contents using sentences and words, but he could not express the visual contents concretely, such as color, shape, or design. KI was conscious of his compensatory strength in verbal processing: He showed advantages in reading/writing abilities at work, and so he was easily able to work successfully when asked to do work that involved reading and writing.

*Measures*

We used Raven's Colored Progressive Matrices (RCPM: Raven, Court, & Raven, 1995) to measure KI's visual ability. Moreover, to examine KI's imagery abilities, we adopted the QMI (Betts, 1909), which measures the vividness of imagery in seven sensory modalities (visual, auditory, tactile, pain, gustatory, olfactory, and somatic images), VVIQ (Marks, 1973) measuring the vividness of visual imagery, TVIC (Gordon, 1949; Richardson, 1969) measuring controllability, VVQ (Richardson, 1977) measuring cognitive style, and AIQ (Hishitani, 2009), which can assess vividness of auditory imagery.

*Procedures*

We visited the area where KI lived and conducted questionnaires and interviews in face-to-face situations.

## Results

*Visual ability*

We analyzed the RCPM, and KI obtained a score of 34/36, indicating that there was no problem in his visual ability.

*Imagery abilities*

The QMI shows higher rating points for a weaker vividness of imagery. KI rated five questions in each sensory modality using a 7-point Likert scale (from 1: *no image at all, you only "know" that you are thinking of the object* to 7: *perfectly clear and as lively as seeing it for real*). He showed 10/35 points for auditory images although he gave the lowest point (5/35 points) to other sensory modalities. This means that he could weakly create the auditory images, but he judged other images as "not an image at all." To measure the vividness of visual imagery, KI took the VVIQ; lower scores on the VVIQ indicate weaker vividness of imagery. KI rated 16 questions using a 5-point Likert scale (from 1: *no image at all, you only "know" that you are thinking of the object* to 5: *perfectly clear and as lively as seeing it for real*). He gave the lowest point (16/80 points), again indicating that he rated all visual images as "not an image at all."

To measure the controllability of visual images, we used the TVIC, on which higher scores indicate weaker controllability of visual images. KI rated 12 questions on a three-category

scale (yes: I can change the visual images, no: I cannot change the visual images, and unsure). KI responded "unsure" for all questions, indicating that he could not judge his control of the images because his visual images were quite weak.

To measure cognitive style, we used the VVQ, on which higher scores reflect stronger strategies of verbalization or visualization. KI rated 30 questions including verbal and visual strategies using a two-category scale (yes or no). He scored 3 and 0 on each item for verbal and visual strategies, respectively.

Finally, to assess the vividness of his auditory imagery, we adopted the AIQ, on which higher scores indicate weaker vividness of imagery. KI rated 12 questions using a 5-point Likert scale (from 1: *no image at all, you only "know" that you are thinking of the object* to 5: *perfectly clear and as lively as seeing it for real*). He scored 52/60 points, indicating that his auditory imagery might show a substantial deficit but not a complete deficit.

## Discussion

The present study reported a single Japanese case of aphantasia by focusing on the participant's imagery abilities and using a questionnaire method. Considering his episodes and performance on the RCPM, his visual ability and reading/writing abilities might be intact. With regards to the vividness of his imagery abilities, his auditory imagery might be weak but relatively intact, whereas his other sensory modalities, including visual imagery, show a complete deficit. Moreover, he could not judge the controllability of images because of his blind imagination, and we found that his cognitive style might mainly involve verbal, not visual, strategies.

KI realized his blind imagination in his twenties while he talked to his friends. This situation is similar to those of previous reports (Zeman et al., 2015). Zeman et al. (2015) suggested that people typically became aware of their blind imagination in their teens or twenties through conversation or reading. Moreover, KI was aware of his compensatory strength in verbal processing (reading and writing). This compensatory strength in an individual with aphantasia is also similar to previous findings (Zeman et al., 2015), which indicated that individuals with aphantasia identified compensatory strength in the verbal, mathematical, and logical domains. Through a deficit of visual imagery, people with aphantasia may show compensatory enhancement of other abilities involving verbal processing. However, we should carefully interpret KI's verbal ability because our present study did not examine it using a standardized examination.

A previous study (de Vito & Bartolomeo, 2016) indicated that people with aphantasia may have related psychopathological factors. KI also had been diagnosed with depression in his thirties. However, he had already realized blind imagination in his twenties, indicating that his blind imagination might be lifelong. Although some overlap may be assumed between aphantasia and congenital prosopagnosia, as indicated by Zeman et al. (2016), KI could differentiate between faces (such as those of his wife and sons), and thus our case might not be

one of congenital prosopagnosia; and while it might be congenital aphantasia (see also Zeman et al., 2015), it was not acquired (or psychopathological) aphantasia.

Regarding the imagery abilities of our case, the vividness of his visual, tactile, pain, gustatory, olfactory, and somatic images showed a complete deficit (QMI). Moreover, the VVIQ scores in our case were similar to those in previous studies (Jacobs et al., 2018; Keogh & Pearson, 2018; Zeman et al., 2015), suggesting that our case showed a complete deficit in visual imagery although his visual ability was intact (RCPM). Zeman et al. (2016) proposed the possibility that there are subtypes of congenital aphantasia. One group showed substantial deficit and the other group showed complete deficit in visual imagery; our case may be assigned to the latter group. Moreover, we report the individual's auditory imagery ability of aphantasia, while most previous studies have focused on the vividness of visual imagery. We found that KI showed a substantial deficit in auditory imagery, indicating that his auditory imagery might be relatively intact compared to other sensory modalities. We assume that this ability may affect the compensatory strength in his verbal processing.

Furthermore, we reported not only vividness but also the controllability and cognitive style of imagery abilities, which have not been reported by previous studies. We used TVIC to investigate controllability, but KI could not change the images because of his blind imagination. Moreover, to assess cognitive style, we used the VVQ. We found that KI might have adopted a verbal style related to his strength in verbal processing. In addition to the vividness of visual imagery, we should focus on other sensory modalities with a variety of imagery abilities to reveal the strengths and abilities of individuals with aphantasia.

This study examined imagery ability using a questionnaire method, and recent studies (Dawes, Keogh, Andrillon, & Pearson, 2020; Zeman et al., 2020) reported important findings in relation to various perspectives, such as synesthesia, autobiographical and episodic memories, and object/spatial imagery. Although we also thought that the questionnaire method is sufficient to reveal imagery ability, we feel that we should also collect data using perceptual and cognitive tasks (including behavioral and physiological data), because one might argue that the questionnaire method is subjective (Borst & Kosslyn, 2008, 2010). Previous studies (Bainbridge et al., 2021; Jacobs et al., 2018; Keogh & Pearson, 2018; Wicken et al., 2019) have already presented behavioral data using perceptual and cognitive tasks. We should collect many individuals with aphantasia for these experimental examinations. Although almost no physiological examinations of individuals with aphantasia have been conducted (Dijkstra et al., 2019), these data are also needed to reveal the specific characteristics of aphantasia.

One effective means of support is to spread an understanding of aphantasia to decrease difficulties in the lives of individuals with aphantasia. However, in Japan, there have been almost no reports of aphantasia. Our case study may be the first to examine a Japanese individual with aphantasia. Based on our preliminary case study, we expect that the study of aphantasia could be developed in Japan and an understanding of aphantasia spread in the Japanese society.

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